Tilburg University

Economics of Installing a CO2 Tax in the Dutch Tax System

Gerlagh, Reyer; van Tilburg, Rens; van Wijnbergen, Sweder; Carton, Linda

Publication date:
2019

Document Version
Publisher's PDF, also known as Version of record

Economics of Installing a CO2 Tax in the Dutch Tax System

Gerlagh, Reyer; van Tilburg, Rens; van Wijnbergen, Sweder; Carton, Linda

Economics of installing a CO2 tax in the Dutch tax system

Paper for a Science - Politics Roundtable in the Dutch House of Parliament

Reyer Gerlagh[1], Rens van Tilburg[2], Carolyn Fischer[3], Sweder van Wijnbergen[4], Linda Carton[5].

[1] Tilburg University, [2] University Utrecht, [3] VU University Amsterdam,
[4] University of Amsterdam, [5] Radboud University.

This paper has served as input for a science-politics roundtable, held on 10 April 2019 in The Hague, the Netherlands.

Disclaimer:

The paper originates from an email exchange, rooted in societal debate about pricing pollution in several scientific and science-policy oriented circles in the Netherlands. After a framework for a new Climate Law had been designed at the end of 2018, a societal discussion has followed how to include industry, or in general any economic sector, in future climate policy in the Netherlands. In 2019, national legislation is prepared in the Netherlands on the design of a national carbon levy. An email exchange started, temporary and oriented at the specific topic of a carbon levy and the carbon leakage problem. A newspaper letter, discussion about (political) motions, and email letters led to the initiative for a small, time-bound roundtable discussion in the spring of 2019, in the Dutch Parliament in The Hague. This roundtable is the purpose of this paper.

The paper does not serve any other purpose and should be read in light of the limited timeframe to write down a short discussion note, with the insights readily available in the week(s) before the roundtable discussion between scientists and politicians. The paper is written as a working paper for a focussed, substantive dialogue between a small group of scientists and members of parliament, in an ad-hoc roundtable about policy options for taxing greenhouse gas emissions in 2019. This paper is written to explore options of designing a national Carbon Levy or ‘CO2 tax’ instrument, the expected Carbon Leakage effects, and explore what can be done about these expected leakage effects and responses in the international and domestic markets. The principles and advices are written on the basis of personal expertise, overview and insight over recently published empirical studies, acknowledging bounded rationality and fundamental differences between the nature of scientific debate and political debate. The scientists have written this paper for contributing to the knowledge base of political decision-making for the national policy regime on greenhouse gas emissions in the Netherlands. This paper is neither based on grants nor other types of funding.

Abstract

This paper is written for an ad-hoc roundtable of economic and governance scientists, to advice politics, in spring 2019. The objective of this working paper is: The design of a national Carbon Levy and the expected Carbon Leakage effect and what can be done about this. With this paper, scientists aim to advice politics on the design and implementation of a carbon tax in the Netherlands. This text is originally written as a discussion letter, serving as input for an informal roundtable with a small society of scientists and politicians. This exploratory science-policy roundtable has been held on 10 April 2019 in the Dutch Parliament, with nine people around the table, half senior & half junior, half science & half political representatives. This paper forms the input, discussing a few options and consequences, in order to explore the 'space' for political and economic maneuverings into a future pathway that is *consistent* with climate science and with international agreements (the Paris Climate Agreement), as well as a *feasible* pathway in the current global and European market context and in the actual national political constellation.

The roundtable serves to gain understanding across the boundaries of scientific circles and political systems, communicating both theoretical and practical insights. A diverse set of ingredients, both market-based and politics-based, limit the scope and feasibility of options for action, marking a significant divide between what is theoretically desirable and what is currently practically and politically possible, given the realities of a fragmented political landscape and polarized political viewpoints regarding climate change policy in the current timeframe. The roundtable is meant to deliberate the latest empirical analyses on the topic of taxing greenhouse gas emissions (expressed as CO2-equivalent tonnes), and learn from each other first-handedly about actual imperfect circumstances. The roundtable has been held after a party-internal motion on the topic of installing a CO2 tax had been accepted within one of the larger democratic political parties in the Netherlands. The paper contains a Dutch summary, principles and execution considerations of policy measures and considerations, a glossary of terms, and a short cv of the authors.

Table of Content

Summary in Dutch (Samenvatting in het Nederlands)

Korte samenvatting van hoe economen naar een CO_2 heffing kijken.

I. Prikkels op bedrijfsniveau.

1. Economen willen graag dat elke ton CO_2 die een bedrijf kan besparen hetzelfde voordeel oplevert voor het bedrijf. Dit heet marginale beprijzing.

a. Dat betekent dat er geen vrijstelling is waaronder de CO_2 ongeprijst is voor een bedrijf!

b. Als een bedrijf een emissie-vrijstelling heeft, dan is het de bedoeling dat het bedrijf geld toe krijgt bij lagere emissies!

c. Empirisch onderzoek laat zien dat echte prijsprikkels systematisch meer resultaat opleveren (meer reductie) voor lagere kosten dan afspraken met bedrijven op basis van expert-opinies (onderhandelen over doelen en vergoedingen). Bijv. kosten van milieumaatregelen vallen lager uit dan vooraf gedacht als bedrijven moeten concurreren om deze maatregelen te mogen nemen tegen een vergoeding.

2. De vrijstelling van CO_2 emissies moet objectief zijn en gebonden zijn aan de schaal van de bedrijfsvoering. Dit heet evidence-based conditioneel terugsluizen.

a. Een bedrijf mag geen vrijstelling houden als het de poorten sluit.

b. De mate van terugsluizen mag geen onderdeel worden van onderhandelingen waarbij het bedrijf een informatievoorsprong heeft.

c. Beiden kunnen worden bereikt door dezelfde output-maat te gebruiken als de EU.

3. Een vrijstelling moet alleen gegeven worden als het bedrijf zware internationale concurrentie ondervindt. De combinatie van marginale beprijzing en conditioneel terugsluizen zorgt ervoor dat de totale kosten voor de bedrijven in Nederland niet zo sterk stijgen, zodat ze niet naar het buitenland vertrekken. Tegelijkertijd zorgt het er voor dat de bedrijven wel hun best doen om elke ton CO_2 te verminderen.

a. Zoveel als mogelijk moeten de inkomsten uit CO_2 heffingen teruggegeven worden aan de hele economie door andere belastingen te verlagen. Rondpompen van geld kost geld.

b. Het idee van marginaal versus gemiddelde kosten vinden veel mensen moeilijk te begrijpen, een voorbeeld kan verhelderen. Stel dat bij de huidige technologie voor elke ton staal 0.5 ton CO_2 nodig is. Stel, we weten dat de emissies met 40% omlaag moeten. Stel, de prijs van CO_2 zetten we op 40 euro/ton, en we combineren dat met een vrijstelling van 0.3 ton CO_2 per ton staal. Dat betekent dat als de fabriek zonder innovaties blijft draaien, dat het dan over 0.2 ton CO_2 x 40 eur = 8 euro moet betalen per ton staal. Als de fabriek een nieuwe technologie gebruikt die maar 0.2 ton CO_2 uitstoot per ton staal, krijgt de fabriek 0.1 ton CO_2 x 40 euro = 4 euro per ton staal dat het produceert als negatieve (!) CO_2 belasting.

4. Een subsidie voor de onrendabele top bij innovatieve investeringen (SDE++) is wenselijk als er de verwachting is dat deze type investeringen in de toekomst voor andere bedrijven wel rendabel zullen zijn.

II. Verdeling over de economie.

5. Economen willen graag dat er een vloer is over de hele economie voor de (marginale) CO_2 prijs. Dus geen uitzonderingen voor glastuinbouw, landbouw, enz. De ETS-sectoren betalen dan alleen het verschil met de ETS prijs.

a. Een verschillende prijs voor verschillende sectoren betekent dat de ene sector veel harder de best doet dan een andere sector. Dat is verspilling van inspanning.

b. Voor ETS sectoren kan de ETS prijs worden afgetrokken van de vloerprijs.

6. Het niveau van de CO_2 prijs moet dynamisch worden aangepast aan of de doelstellingen bereikt worden.

a. Als NL achterblijft bij de doelstellingen moet de prijs omhoog.

7. De terugsluis en SDE++ kunnen worden aangepast op basis van het niveau van nieuwe investeringen door de energie-intensieve industrie.

a. Als de industrie niet investeert in schone nieuwe capaciteit, is een ruimere SDE++ nodig.

III. Conclusie.

Een economie-brede CO_2 heffing, met objectieve richtlijnen voor terugsluizen voor alleen de industrie die zware internationale concurrentie ondervindt, het gebruik van een beperkt SDE++ instrument, en verlaging van andere belastingen (voor burgers), is de beste oplossing.

1. Principles for a Dutch GHG levy on industrial facilities

Note: The terminology of (Scientific) Principles and Execution are used, in order to make readers see where execution proposals come from, rather than directly aiming at practical outcomes.

Principle 1: Inclusion in Climate Law, unit in Euros per tonne CO2-equivalents

The Dutch GHG levy is part of the Dutch Climate Law. Its level is set in euros per tCO2-equivalents, and decided consistently with the targets specified in the Climate Law.

Principle 2: Price alignment across sectors

The Dutch GHG levy is meant to align the marginal costs of reducing greenhouse gas emissions more consistently across sectors and with the levels needed to achieve the targeted reductions at lowest social costs. The GHG levy does not aim at complete harmonization.

Principle 3: Design of GHG levy with appropriate measures that reduce carbon leakage

The Dutch GHG levy will be designed with appropriate measures that reduce carbon leakage (which is an increase in foreign emissions caused by a domestic decrease). The GHG levy does not aim at complete neutralization of carbon leakage. Nor does the Dutch GHG levy with its related measures aim to protect specific sectors for reasons other than avoiding carbon leakage and enhancing that the environmental effectiveness of the carbon pricing policy.

Principle 4: No cross-interference of GHG levy with use of other policy instruments

The Dutch GHG levy does not interfere with the use of other instruments, either sector-specific or not, such as fuel taxes and house building regulation.

Principle 5. Minimize administrative costs and strategic behavior by firms

The Dutch GHG levy aims at minimizing administrative costs as well as strategic behavior by firms. For this purpose, it uses as much as possible the same data as used by the EU-ETS for its implementation, for those installations covered by the EU-ETS.

2. Execution guidance for implementing the principles in policy practice

Execution 1: Price stability

The Dutch GHG levy level is determined 5 years in advance, so as to enable firms to anticipate. The level determined for after 5 years is decided with the aim to achieve the targets as set in the Climate Law. (Lower projected emissions as compared to the target imply lower levy, while higher projected emissions imply a higher levy.)

Execution 2: Price alignment

The Dutch GHG levy sets a minimum effective price, a so called ‘floor’ in the Dutch GHG market. Some sectors —primarily outside the industrial sectors/ETS sectors— have higher effective GHG prices, e.g. due to fuel taxes, in which case the GHG levy does not apply to that sector. (Thus, if the fuel tax already internalizes all external effects to a proper level, including CO2-equivalent emissions, other environmental effects and congestion, then there is no extra GHG levy applicable.)

Scope of the levy: if designed as an economy-wide minimum price, some installations not covered by the EU ETS may be covered nonetheless by the levy.
See for instance the EU ETS Handbook on small emitting facilities: ‘Installations where the emissions are so small that the administrative costs per unit of emissions might be disproportionately high are allowed to opt-out from the EU ETS as long as they are subject to equivalent measures. Installations are considered small emitters if they emit less than 25 ktCO2e annually and, if they are combustion installations, have a thermal rated input below 35MW.’ (EU ETS Handbook)

Execution 3: Avoid double-taxation

All installations covered by the EU-ETS are subject to a reduced Dutch GHG levy. The reduced level is such that the EU-ETS price, averaged over the 12 months prior to 1 July the year before, plus the reduced GHG levy, equals the floor GHG price set for facilities not covered by the EU-ETS.

Execution 4: Address carbon leakage

All installations in sectors identified as *energy-intensive and trade-exposed* (EITE) under the EU-ETS shall receive commensurate treatment to prevent carbon leakage.[1] The benchmarks for free allocation under the EU-ETS are a logical starting point for designing objective and transparent criteria and minimizing administrative costs.[2] These benchmarks can be used to design tax refunds in accordance with EU State Aid Guidelines.[3] Although those guidelines allow a reduced tax *rate* for qualifying sectors, the environmental objectives are better preserved by maintaining the strong carbon price signal and using tax *rebates* based on a measure of current or historical output, rather than emissions.[4]

> Option 1: Each facility will be assigned “benchmark emissions,” as calculated by the EU benchmark rate multiplied by the facility’s total production, either in the previous year or in the most recent base

year used in the ETS.[5] For EITE-designated facilities, the *basis* for the levy shall be the total verified emissions in excess of their benchmark emissions; if verified emissions fall below the benchmark, a levy credit shall be issued.

For installations covered by the EU ETS, the reduced levy will be applied to this same basis.

Equivalently, at the end of the year, qualifying facilities will be given a tax refund equal to their benchmark emissions multiplied by their relevant levy rate.

A common adjustment factor can be applied to ensure that total benchmark emissions do not exceed 80% of the total verified emissions attributed to the EITE installations in the prior year.

Option 2: If the levy is only applied to installations covered under the EU ETS, actual EU ETS free allowance allocations can be used to calculate the tax basis or tax refund. While simple, this method has some limitations: First, it does not work for uncovered firms, like small installations. Second, free allocation under the EU ETS faces several adjustments from the benchmarks that lead to reduced allocations, and the resulting compensation may be inadequate to address leakage, especially given the added potential for internal EU leakage that a unilateral levy can generate.

Option 3: The benchmark rate could be used as the basis for setting a performance standard, for which compliance would be tradable. In this case, facilities are awarded credits equal to the benchmark rate per unit of current production. Those with verified emissions below their benchmark emissions can sell credits to entities with emissions above the standard. The carbon levy rate would serve as a ceiling for the tradable credit prices.[6] If the benchmarks are ambitious, one would expect the carbon levy rate to prevail. This kind of market-based regulation is likely to satisfy State Aid exemptions for equivalent effects while retaining the output-based-updating feature. However, if both EU ETS covered and uncovered facilities participate, some thought is required to avoid both double counting and tax arbitrage.

Some additional options deviate further from the EU ETS free allocation strategy. Although border carbon adjustment is not an option for the Netherlands on its own, it could be mimicked by combining output-based rebating for domestic covered facilities plus a carbon-based consumption tax on those products.[7]

Another option is to use part of the revenues to support investments required to switch to low-carbon production methods.[8] If costs are lumpy, conditioning refunds on such investments can encourage emission reductions and lessen leakage (since post-investment, marginal production costs will be less sensitive to carbon prices). If low-carbon production raises marginal production costs, however, output-based rebating more directly offsets leakage. This may inform SDE++ design.

Finally, some consideration should be given to whether any sectors not deemed EITE under the EU ETS, due to limited competition outside the EU, may in fact be subject to carbon leakage within the EU to producers in other member states. Electricity is an example.[9] Analysis should be done to see if any relevant sectors covered by the carbon levy are not in the EU ETS benchmarking scheme.

[1] See Annex II of the ETS State Aid Guidelines, OJ C 158, 5.6.2012, p. 4.

[2] https://ec.europa.eu/clima/sites/clima/files/ets/allowances/docs/p4_gd2_allocation_methodologies_en.pdf

[3] State Aid Guidelines state that aid in the form of reductions in or exemptions from environmental taxes are allowed either by a reduced rate or a fixed refund based on a historical base year provided; explicit output-based rebating thus does not seem provided for, although it has been used in the past (e.g., Sweden's NO_x tax). Additional restrictions are that the beneficiaries must pay at least 20% of the national tax and not pay below the Union minimum tax level set by the relevant applicable Directive [in this case, perhaps, the EU ETS liability]. Alternatively, the tax reduction must be made conditional on agreements to achieve equivalent reductions.

[4] See, e.g., Fischer, Carolyn (2015) "**Options for avoiding carbon leakage**", Chapter 21 in *Towards a Workable and Effective Climate Regime*, edited by Scott Barrett, Carlo Carraro, Jaime de Melo. https://voxeu.org/sites/default/files/file/fischer.pdf

[5] The latter would promote alignment with the EU ETS and certainly satisfy State Aid Guidelines; the former, however, is likely more effective at combatting leakage, as the updating provides an inducement to production.

[6] A similar scheme has been used in the Canadian province of Alberta.

[7] Neuhoff, K., R. Ismer, W. Acworth, A. Ancygier, C. Fischer, M. Haussner, H.-L. Kangas, Y.-G. Kim, C. Munnings, A. Owen, S. Pauliuk, O. Sartor, M. Sato, J. Stede, T. Sterner, M. Tervooren, R. Tusveld, R. Wood, Z. Xiliang, L. Zetterberg, and V. Zipperer. 2016. Inclusion of Consumption of carbon intensive materials in emissions trading – An option for carbon pricing post-2020. Berlin: Climate Strategies.

[8] Under State Aid Guidelines, eligible costs for aid include "the additional investment costs necessary to go beyond the level of environmental protection required by the Union standards,:" or in the absence of such standards, "the investment costs necessary to achieve a higher level of environmental protection than that which the undertaking or undertakings in question would achieve in the absence of any environmental aid." (Annex 2)

[9] California has implemented a kind of border carbon adjustment for electricity imports from other states.

Discussion points on Execution 4, address carbon leakage

Discussion about rebate mechanism:

CF: Involving a consistent minimum price, proposed here is that all companies get the same EU ETS-based benchmarks. All pay the minimum tax rate, but for the ETS firms their tax rate is a top-up. Both ETS-firms and other firms get a rebate equal to their benchmark emissions times their tax rate. For the ETS firms, the Dutch tax rebate will be lower because they pay a lower rate. However their total tax and total rebate will be about the same, because it combines the Dutch levy and ETS free allocation values. If double taxation of ETS firms is proposed (no tax rate offset to reflect allowance prices) then their rebate should be based on the full rate. In total they will pay more on the margin but on average be full (or 80%) compensated for the embodied emissions costs.

About benchmarking and free allocation or Output-Based Allocation to combat leakage:

CF: If all 'large industries in the Netherlands' are already covered by the ETS, then the benchmarking has already been done, and that can be a starting point for free allocation or Output-Based Allocation (OBA) with more frequent updating. That way the value of their free allocation, which is intended to combat leakage, will increase commensurate with the emissions price increase. Since this is a *tax rebate* rather than an allowance allocation, though, will need to check state aid rules, but it does follow the spirit of the EU method. (One could also achieve the same thing with a *tradable performance standard* with a safety valve at the levy price).

3. Other matters of concern for implementing a Carbon tax in the Netherlands

Consideration 1: Safeguarding low income groups

It is a political (distribution) consideration, but it may be a good idea for the acceptability of this levy in society, to compensate lower income groups if they are affected by higher taxes or higher costs of primary living standards and necessary monthly costs (housing rent, energy bills, etc.).

Consideration 2: Distribution of costs of the energy transition

On the topic of distributing the costs of the energy transition between households and business sectors, we should realize that so far, the Electricity sector has received huge subsidies through the SDE+ arrangement. From recent news coming from the ministry of Economic Affairs and Climate, we understand that a new SDE++ arrangement for the industry is in the making, and to be expected as part of the Carbon levy plans. This means that in the end, the industry will not really pay, they will not pay more than what they get back… This is an interesting question, but difficult to discuss without the details of plans for the SDE++ arrangement. If we could get information about ideas of government to design the SDE++ arrangement, economists could study its possible impacts ex-ante…

Consideration 3: Research needed to determine impact on low-income consumers

Given the chosen design, analysis should be performed to determine the impact on low-income consumers and potentially displaced workers. Note that EITE industries are by definition unable to pass through substantial cost increases, and compensation strategies further offset their incentive to do so, in which case large consumer impacts are not expected (and those tax revenues are already largely foregone due to refunding). For non-EITE sectors, tax revenues can be used to address adverse distributional effects. (However, for these non-EITE sectors, with output-based rebating, or with strong international competitions, the price impacts for consumers may also be limited, so less redistribution is then required from an industrial levy.)

Consideration 4: Societal support for climate policy

Societal support for climate policy has not been addressed directly in this discussion letter. In order to keep support for climate related policy interventions, it is necessary not only to focus on economic systems and (major) firms and carbon emitting installations, but also to look at the wider public, wider perspectives and discourses about climate policy, and communication and representation aspects. Some political parties spread a message that carbon policy is expensive and does not matter for the environment. Although this argument can be de-masked, it still sticks in people’s minds after framing climate policies in this way.

A carbon tax as price signal represents a symbolic message that polluting will be taxed by government, that pollution-reduction will be made worthwhile in a new fiscal regime, and that businesses will be made accountable for paying their share for environmental pollution. Measures to prevent leakage are part of the transition, but these measures may feel somewhat ‘unjust’.

Moreover, it could be debated that measures protecting emission-intensive industries (such as leakage measures) may protect jobs and industries that otherwise would relocate on the short term, but these leakage measures may hinder (new) climate-innovative firms in the long run.

4. Glossary of concepts and its explanations

Concept 1. Effective carbon rate (ECR)

From OECD (2018), Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading.

Effective carbon rates are the total price that applies to CO2 emissions from energy use as a result of market-based policy instruments. They are the sum of taxes and tradable emission permit prices, and have three components:

1. carbon taxes, which typically set a tax rate on energy based on its carbon content,
2. specific taxes on energy use (primarily excise taxes), which are typically set per physical unit or unit of energy, but which can be translated into effective tax rates based on the carbon content of each form of energy, and
3. the price of tradable emission permits, regardless of the permit allocation method, representing the opportunity cost of emitting an extra unit of CO2.

The effective carbon rate measures how policies change the relative price of CO2 emissions from energy use.

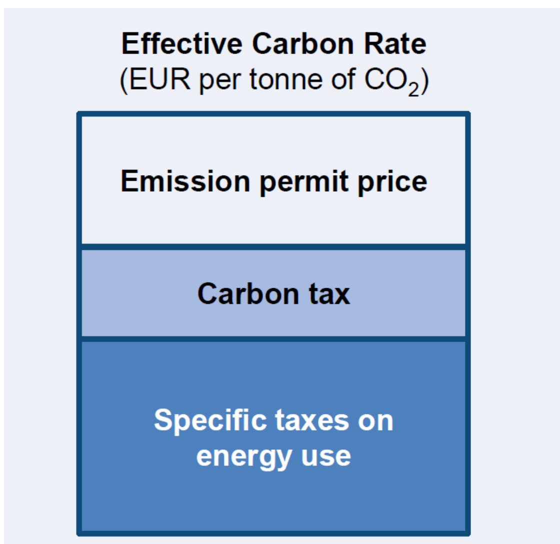

Figure 1.Components of effective carbon rates Source: OECD (2016) Effective Carbon Rates: Pricing CO2 through Taxes and Emissions Trading Systems, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264260115-en.

From: OECD (2018), Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading, OECD Publishing, Paris. https://doi.org/10.1787/9789264305304-en.

Concept 2. EITE sectors

Sectors identified as energy-intensive and trade-exposed (EITE) under the EU-ETS .

Concept 3. Output-Based Allocation (OBA) and Output-Based Rebating (OBR)

Output-based allocation (OBA) or output-based rebating (OBR) is a method of allocating the allowance values (in an emissions credit trading program) or refunding emissions revenues (in the case of a tax) back to affected firms in proportion to their output. This basis for allocation is updated regularly according to actual output, not based on a fixed historical measure. “Since more output generates more rebates, the rebate functions like a subsidy to output of EITE firms, signalling that emissions reductions should not be sought through reductions in output (since that would result in leakage). The advantage relative to exemptions is that OBR retains the carbon price incentive to reduce emissions intensity. However, it does come at a cost of muting the carbon price signal passed on to consumers, who then have less incentive to consume less energy-intensive products or find cleaner alternatives.”[1]

OBR is thus used for sectors that, due to international competition, are severely limited in their ability to past on carbon cost increases, as a means to avoid loss of competitiveness vis-à-vis trade partners lacking similar carbon pricing. OBA has been used in New Zealand’s cap-and-trade system. OBR is being used for energy intensive industries in certain Canadian provinces, including Alberta, Ontario, and in the federal carbon backstop pricing plan. Sweden used output-based refunding of NO_x emissions taxes to garner support for a much higher tax than would otherwise have been acceptable. OBR may be considered a form of state aid, but according to the guidelines, “While reductions in or exemptions from environmental taxes may adversely impact that objective (76), such an approach may nonetheless be needed where the beneficiaries would otherwise be placed at such a competitive disadvantage that it would not be feasible to introduce the environmental tax in the first place.”[2]

Tradable performance standards are another form of OBR. The intent of any OBR system is to encourage meaningful GHG reductions by 2 mechanisms:

1. Comparing facilities against their cohort of peers to encourage leaders.
2. Sending a price signal to influence future investments.

---

[1] Fischer (2015), supra note 5.

[2] 3.7.1. (167) in EC 2014/C 200/01.

Sources:

Emissions Trading in Practice : A Handbook on Design and Implementation https://openknowledge.worldbank.org/handle/10986/23874

https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/output-based-pricing-system.html

Example of Alberta, Canada, has implemented OBA

Output-based Allocation (OBA) is included in regulation for CO2 emission policy since January 2018.

The Alberta OBA applies to:

- facilities that are large emitters over 100,000 tonnes,
- sectors and facilities that qualify to opt-in sectors that are emissions intensive and trade exposed. (or like for like)

The intent of the OBA system is to encourage meaningful GHG reductions by 2 mechanisms:

1. Comparing facilities against their cohort of peers to encourage leaders.
2. Sending a price signal to influence future investments.

OBA in Alberta provides free allocations to regulated sectors and facilities to minimize the risk of carbon leakage due to production moving from Alberta to jurisdictions without carbon pricing.

Source: https://www.alberta.ca/assets/documents/CCI-OBA-presentation-Dec-2017.pdf

About Output-based Rebating, a study on Canada - US neighbouring policy

Christoph Böhringer, Brita Bye, Taran Fæhn, Knut Einar Rosendahl (2017) Output-based rebating of carbon taxes in a neighbour's backyard: Competitiveness, leakage and welfare. First published: 10 May 2017 https://doi.org/10.1111/caje.12264.

Abstract (Christoph Böhringer et al's paper on Output-based rebating of carbon taxes)

We investigate how, in an open economy, carbon taxes combined with output-based rebating (OBR) perform in interaction with the carbon policies of a large neighbouring trading partner. Analytical results suggest that, whether the purpose of the OBR policy is to compensate firms for carbon tax burdens or to maximize welfare (accounting for global emission reductions), the OBR rate should be positive in policy-relevant cases. Numerical simulations for Canada, with the US as the neighbouring trading partner, indicate that the impact of US policies on the OBR rate will depend crucially on the purpose of the Canadian OBR policies. If, for a given US carbon policy, Canada's aim is to restore the competitiveness of domestic emission-intensive and trade-exposed (EITE) firms to the same level as before the introduction of its own carbon taxation, we find that the necessary domestic OBR rates will be insensitive to the foreign carbon policies. However, if not only the Canadian carbon tax but also an equally high US tax is introduced, compensatory Canadian OBR rates will be up to 50% lower, depending on the sector and on US OBR policy. If the policy objective is to increase economy-wide allocative efficiency (welfare) of Canadian policies by accounting for carbon leakage, the US policies will have only a minor downward pressure on desirable OBR rates in Canada. Practical choices of OBR rates hardly affect overall domestic economic performance; thus, output-based rebating qualifies as an instrument for compensating EITE industries without a large sacrifice in terms of economy-wide allocative efficiency.

Source: https://doi.org/10.1111/caje.12264.

Concept 4. Output-Based Allocation plus Consumption Tax (OBA-CT)

By subsidizing production, OBA mutes the pass-through of the carbon price signal to consumers. It generally should be applied when intense international competition limits that pass-through. In either case, when carbon cost pass-through is limited, consumers have insufficient incentives to reduce their consumption of the emissions-intensive good or to find alternatives. *A consumption tax equal to the carbon levy multiplied by a benchmark emissions intensity can correct incentives for the consumers.* Since the consumption tax is applied regardless of the product's origin, it does not distort competitiveness. **Used in combination, OBA addresses competitiveness-related carbon leakage while the consumption tax ensures pass-through of the carbon price signal.**

Source: http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2016/06/CS-Report.pdf

Research Study on Output-Based Allocation plus Consumption Tax system (OBA-CT)

Insights about this combination of policy instruments is, amongst others, based on the results from a game-theoretical economic simulation study by Kevin Raj Kaushal, Norwegian University of Life Sciences School of Economics and Business, Working Paper 08/2018. The paper is titled: Emission price, output-based allocation and consumption tax: Optimal climate policy in the presence of another country's climate policy.

The paper investigates an emission price, existing of output-based allocation and consumption tax. The modeling study seeks an optimal climate policy in the presence of another country's climate policy, with help of examining the Nash equilibrium of a policy instrument game between regions who regulate their emissions separately. In the study, a case is investigated when a policymaker can choose to supplement her ETS with OBA and/or with a consumption tax, based on another policymaker's optimal choice for her ETS. The two examined parties in this paper are the EU and China.

Conclusion section from this study:

"As rest of the world closely follows the unilateral initiatives by EU and China, the policymakers in these markets are well aware that their unilateral action leads to carbon leakage without a global initiative to reduce emissions. There are many different approaches in the economic literature to mitigate carbon leakage. A very common anti-leakage solution in emission trading systems is output based allocation (OBA) to emission-intensive and trade-exposed (EITE) industries. OBA, however, works as an implicit production subsidy to domestic production of EITE goods. Hence, an approach *to supplement OBA with a consumption tax on all use of EITE goods* have been proposed. In this paper we have examined the choice of a climate policy instrument for a region, in the presence of another region's climate policy, applied to the EU and China. First we showed analytically that the effect on the optimal OBA and optimal consumption tax for a country is ambiguous if another country introduces an OBA or a consumption tax. However, we also showed that under certain conditions the optimal consumption tax for a country is reduced, if another country introduces an OBA or a OBA and consumption tax. Next, we examined the choice of policy instrument for two separate countries with a stylized numerical model calibrated to real world data, where we considered the situation of the EU ETS and the Chinese ETS. The results showed that depending on certain conditions, the countries would choose different variation of policy combinations. *In the context of maximizing welfare and minimizing leakage rate, both countries would implement a consumption tax on top of the OBA.* Further, the numerical results showed that the strategies in all the Nash equilibrium outcomes were also the dominant strategy for the region. The tax implementing countries were consistently better off in terms of welfare and leakage rate. Thus, the paper conclude that complimenting output-based allocation with a consumption tax is likely a strong policy strategy to mitigate carbon leakage, even in the presence of other region's climate policy."

Reference: Kaushal, Kevin Raj (2018) Emission price, output-based allocation and consumption tax: Optimal climate policy in the presence of another country's climate policy. Norwegian University of Life Sciences School of Economics and Business, Working Papers no.8/2018. ISSN: 2464-1561. https://www.nmbu.no/download/file/fid/33498.

Concept 5. SDE++ arrangement for the industry (in Dutch)

SDE++: (in het Nederlands) De Stimuleringsregeling Duurzame Energieproductie (SDE+) zal met ingang van 2020 worden verbreed. De regeling zal zich gaan richten op CO2-reductie en zich niet meer beperken tot duurzame energieproductie. Doel van de SDE++ is om op een kosteneffectieve manier bij te dragen aan het bereiken van een emissiereductie van 49% in 2030. Net zoals in de huidige SDE+, zal de SDE++ technieken stimuleren door de onrendabele top te vergoeden. Het verschil is dat technieken in het vervolg concurreren op basis van 'vermeden CO2' (en andere broeikasgassen) in plaats van 'opgewekte duurzame energie'. De technieken moeten, net als in de huidige SDE+, marktrijp zijn en grootschalig kunnen worden ingezet. Om concurrentie op CO2-reductie te stimuleren, zullen technieken die kosteneffectief CO2 reduceren, het eerst in aanmerking komen voor subsidie. De SDE++ wordt in samenspraak met marktpartijen, momenteel verder uitgewerkt. Hierbij wordt gekeken welke technieken in aanmerking komen, welke subsidiebedragen per techniek gelden en of er productie- of budgetplafonds wenselijk zijn. Bron: https://www.ugoo.nl/nieuws/sde-wordt-in-2020-sde/

Annex 1. Short CVs of authors

Reyer Gerlagh

In 1999 Reyer Gerlagh received his PhD in economics and worked at the Institute for Environmental Studies, Vrije Universiteit. He visited Oslo, January-June 2006, and moved to University of Manchester in 2006, where he held a chair in Environmental Economics. Since 2009, he is Professor of Economics at Tilburg University. From 2011 to 2014, he was coordinating lead author of the fifth assessment report of the IPCC, Working Group III. He is now Head of the Economics Department, jointly with Jan Boone, in Tilburg.

Reyer Gerlagh mainly publishes in international journals. For his research he uses theory models, simulation models both and empirical models. Keywords include efficient climate policies, green paradox, economic growth, sustainability, innovation, EU-ETS.

Main relevant publications (focus on last 3 years, between square brackets the relevance for this group):

Gerlagh R. and R.J.K. Heijmans, "Climate-Conscious Consumers and the Buy, Bank, Burn Program", conditionally accepted for Nature Climate Change June 2019. [I know relevant details of the EU ETS MSR system. In this paper we construct a loophole that enables carbon-killing NGOs to leverage carbon burning.]

Gerlagh R. and M. Liski (2018), Consistent Climate Policies, *JEEA* 16(1):1-44. WP version: Carbon prices for the next thousand years. [I've thought deeply about the question of 'optimal' global climate policy and I am well aware of relevant literature.]

Gerlagh R. and M. Liski (2018), Carbon prices for the next hundred years, *the Economic Journal* 128: 728-257. [as above]

Victor, D.G., R. Gerlagh, and G. Baiocchi (2014), Getting serious about categorizing countries, *Science* 345: 34-36. [I'm well aware of differences between countries background]

Dengler S., R. Gerlagh, S. T. Trautmanna, G. van de Kuilen (2018), Climate policy commitment devices, JEEM 92:331-343 [I've also thought about second-best policies when policy-makers cannot commit to first-best instruments]

van Soest D., J.A. Smulders, R. Gerlagh (2018), Lessen voor het Nederlandse klimaatbeleid, Pre-adviezen KVS: 167-175. [The pre-adviezen for Climate for NL. As editors we took our role seriously]

van den Bijgaart, I., R. Gerlagh and M. Liski (2016) A simple formula for the Social Cost of Carbon, Journal of Environmental Economics and Management 77:75-94. [I'm nowadays able to explain the social costs of carbon to anyone with an academic degree within 5 minutes, including the relevant debates in the literature and Trump's gray-washing.]

van der Zwaan, B.C.C., and R. Gerlagh (2016) Offshore CCS and ocean acidification: a global long-term probabilistic cost-benefit analysis of climate change mitigation, Climatic Change 137:157-170. [I've writte many scenario-based analyses for climate policies.]

Rens van Tilburg

Rens van Tilburg (1974) is lid en directeur van het Sustainable Finance Lab aan de Universiteit Utrecht. Een denktank van wetenschappers van verschillende Nederlandse universiteiten. Van daaruit is hij ook lid van het Sustainable Pension Investments Lab. Na zijn studie economie werkte Rens achtereenvolgens bij KPMG, het Europees Parlement, de Tweede Kamer, de AWTI en SOMO.

Carolyn Fischer

Carolyn Fischer currently holds joint appointments as a professor of environmental economics at the Vrije Universiteit – Amsterdam and as a Canada 150 Research Chair in Climate Economics, Innovation and Policy at the University of Ottawa. She is also a senior fellow with Resources for the Future, a Tinbergen Institute affiliate, a fellow of the CESifo Research Network, and a member of Environment Canada's Economics and Environmental Policy Research Network. She was the Marks Visiting Professor at Gothenburg University 2017-2018 and an EU Marie Skłodowska–Curie Fellow 2014-2016. She is currently Vice President and Council Member for the European Association of Environmental and Resource Economists (EAERE). She has served on the board of directors of the Association of Environmental and Resource Economists (AERE), and currently serves on the scientific board of MCC-Berlin, Euro-Mediterranean Center on Climate Change (CMCC), and the economics advisory board of Environmental Defense Fund. She earned her Ph.D. in Economics in 1997 from the University of Michigan—Ann Arbor. In 1994-1995 she served as a staff economist at the Council of Economic Advisers to the President. She is an expert on environmental policy instrument design, particularly in contexts of international trade, carbon leakage, and technological change.

Selected publications:

Cosbey, A., S. Droege, C. Fischer, and C. Munnings. 2019. Developing guidance for implementing border carbon adjustments: Lessons, cautions, and research needs from the literature. *Review of Environmental Economics and Policy* 13 (1): 3–22. https://doi.org/10.1093/reep/rey020

Fischer, C. and W. Pizer. 2019. Horizontal Equity Effects in Energy Regulation. *Journal of the Association of Environmental and Resource Economists* 6 (S1): 209–237. doi:10.1086/701192

Sterner, T., E.B. Barbier, I. Bateman, I. Bijgaart,1 A.S. Crépin, O. Edenhofer, C. Fischer, W. Habla, J. Hassler, O. Johansson-Stenman, A. Lange, S. Polasky, J. Rockström, H. G. Smith, W. Steffen, G. Wagner, J.E. Wilen, F. Alpízar, C. Azar, D. Carless, C. Chávez, J. Coria, G. Engström, S. C. Jagers, G. Köhlin, Å. Löfgren, H. Pleijel, A. Robinson (2019). Policy design for the Anthropocene. *Nature Sustainability* 2 (January): 14–21. https://doi.org/10.1038/s41893-018-0194-x

Fischer, C. and A. K. Fox. 2018. How Trade Sensitive Are Energy-Intensive Sectors? *AEA Papers & Proceedings*. 108 (May 2018). https://doi.org/10.1257/pandp.20181088

Fischer, C., B. Mao and D. Shawhan. 2018. Trade between Mass- and Rate-Based Regulatory Regimes: Bad for Emissions? In The EMF 32 Study on Technology and Climate Policy Strategies for Greenhouse Gas Reductions in the U.S. Electric Power Sector, *Energy Economics* 73: 326–336 (June). https://doi.org/10.1016/j.eneco.2018.04.031

Fischer, C., M. Greaker, and K.E. Rosendahl. 2018. Strategic technology policy as supplement to renewable energy standards. *Resource and Energy Economics*. 51: 84–98 (February). https://doi.org/10.1016/j.reseneeco.2017.05.006

Fischer, C., L. Preonas, and R. Newell. 2017. Environmental and Technology Policy Options in the Electricity Sector: Are We Deploying Too Many? *Journal of the Association of Environmental and Resource Economists*. 4(4): 959–984 (December). https://doi.org/10.1086/692507

Fischer, C. and S. Salant. 2017. Balancing the Carbon Budget for Oil: the Distributive Effects of Alternative Policies. *European Economic Review*. 99: 191–215 (October). https://doi.org/10.1016/j.euroecorev.2017.04.003

Fischer, C., M. Greaker, and K.E. Rosendahl. 2017. Robust Policies Against Emission Leakage: The Case for Upstream Subsidies. *Journal of Environmental Economics and Management*. 84 (July): 44–61. doi:10.1016/j.jeem.2017.02.001

Fischer, C. 2017. Environmental Protection for Sale: Strategic Green Industrial Policy and Climate Finance. *Environmental and Resource Economics*. 66 (3): 553–575 (March). doi:10.1007/s10640-016-0092-5

Fischer, C. and S. Charnovitz. 2015. *Canada—Renewable Energy*: Implications for WTO Law on Green and Not-So-Green Subsidies, *World Trade Review*. 14(02): 177–210. doi:10.1017/S1474745615000063

Böhringer, C., C. Fischer, and K.E. Rosendahl. 2014. Cost-Effective Unilateral Climate Policy Design: Size Matters. *Journal of Environmental Economics and Management* 67(3): 318–339. doi:10.1016/j.jeem.2013.12.008

Takeda, S., T. Arimura, H. Tamechika, C. Fischer, and A. K. Fox. 2014. Output-Based Allocation of Emissions Permits for Mitigating the Leakage and Competitiveness Issues for the Japanese Economy. *Environmental Economics and Policy Studies* 16:89–110. doi:10.1007/s10018-013-0072-8

Fischer, C. and G. Heutel. 2013. Environmental Macroeconomics: Environmental Policy, Business Cycles, and Directed Technical Change, *Annual Review of Resource Economics* 5: 197-210. doi:10.1146/annurev-resource-091912-151819

Fischer, C. and A. K. Fox. 2012. Climate policy and fiscal constraints: Do tax interactions outweigh carbon leakage? *Energy Economics* 34 (Supplement 2): S218–227 (December). doi:10.1016/j.eneco.2012.09.004

Fischer, C. and A. K. Fox. 2012. Comparing Policies to Combat Emissions Leakage: Border Tax Adjustments versus Rebates, *Journal of Environmental Economics and Management.* 64 (2): 199–216 (September). doi:10.1016/j.jeem.2012.01.005

Fischer, C. and A. K. Fox. 2011. The Role of Trade and Competitiveness Measures in US Climate Policy, *American Economic Review Papers & Proceedings*. 101 (3) (May 2011): 258–262. http://www.jstor.org/stable/29783750

Böhringer, C., C. Fischer, and K.E. Rosendahl. 2010. The Global Effects of Subglobal Climate Policies, *B.E. Journal of Economic Analysis & Policy*. 10 (2) (Symposium): Article 13. doi:10.2202/1935-1682.2583

Reprinted in M.A. Cohen, D. Fullerton and R.H. Topel, eds., *Distributional Aspects of Energy and Climate Policies*, Northampton, MA: Edward Elgar (2013).

Fischer, C. and L. Preonas. 2010. Combining Policies for Renewable Energy: Is the Whole Less than the Sum of Its Parts? *International Review of Energy and Resource Economics* 4 (1): 51–92. doi:10.1561/101.00000030

Fischer, C. 2010. Market Power and Output-based Refunding of Environmental Policy Revenues, *Resource and Energy Economics* 33: 212–230. doi:10.1016/j.reseneeco.2010.04.011

Fischer, C. and A.K. Fox. 2007. Output-based Allocation of Emissions Permits for Mitigating Tax and Trade Interactions, *Land Economics*. 83 (4): 575–599. http://www.jstor.org/stable/27647795

Bernard, A.L., C. Fischer, and A.K. Fox. 2007. Is There a Rationale for Output-based Rebating of Environmental Levies? *Resource & Energy Economics* 29 (2): 83–101. doi:10.1016/j.reseneeco.2006.07.001

Sweder van Wijnbergen

Sweder van Wijnbergen received his PhD from MIT in 1980. From 1980 to 1992, he worked as an economist at the Worldbank. Since 1992 he has been a professor at the University of Amsterdam, interrupted by a position as "secretaris-generaal" at the Ministry of Economic Affairs.
Research interests: Fiscal, monetary, and exchange rate policy, development economics, open economy macroeconomics.
Teaching: International economics, transition economics, growth theory.

Publications:

· Boermans, M. A., & van Wijnbergen, S. (2018). Contingent convertible bonds: Who invests in European CoCos? *Applied Economics Letters*, *25*(4), 234-238. DOI: 10.1080/13504851.2017.1310995 [details]

· Homar, T., & van Wijnbergen, S. J. G. (2017). Bank recapitalization and economic recovery after financial crises. *Journal of Financial Intermediation*, 16-28. DOI: 10.1016/j.jfi.2016.11.004 [details]

· van der Kwaak, C., & van Wijnbergen, S. (2017). Sovereign debt and bank fragility in Spain. *Review of World Economics*, *153*(3), 511–543. DOI: 10.1007/s10290-016-0264-y [details]
Downloads

· Zhao, L., & van Wijnbergen, S. (2017). Decision Making in Incomplete Markets with Ambiguity: a case study of a gas field acquisition. *Quantitative Finance*, *17*(11), 1759-1782. DOI: 10.1080/14697688.2017.1307509 [details] Download

· Kirchner, M., & van Wijnbergen, S. (2016). Fiscal deficits, financial fragility, and the effectiveness of government policies. *Journal of Monetary Economics*, *80*, 51-68. DOI: 10.1016/j.jmoneco.2016.04.007 [details]

· van Wijnbergen, S. J. G., & Willems, T. (2016). Learning dynamics and support for economic reforms: why good news can be bad. *The World Bank Economic Review*, *30*(1), 1-23. DOI: 10.1093/wber/lhu005 [details] Download

· van Wijnbergen, S., & Zhao, L. (2016). Real options in Practice: Valuing Connected Gas Fields in the North Sea. *Journal of Derivatives*, *23*(4), 54. DOI: 10.3905/jod.2016.23.4.054 [details]

· van Wijnbergen, S., & Willems, T. (2015). Optimal learning on climate change: why climate skeptics should reduce emissions. *Journal of Environmental Economics and Management*, *70*, 17-33. DOI: 10.1016/j.jeem.2014.12.002 [details]

Linda Carton

Linda Carton (F, 1974) is assistant professor in Planning and Mapping. Her research is focused on collaborative planning and mapping for sustainable cities. She is committed to following the science on climate change and 'bottom-up' citizen initiatives. She looks at government's best practices, and mistakes, in dealing with the related sustainability challenges of climate adaptation and mitigation in cities and regions. An ongoing fascination is the emergence of conflicts between local scale and city-level or state-level decision-makers on governing collective natural resources or "commons," and dealing with "externalities". The core application domain is the field of -smart, sustainable, healthy- cities and regions. Her students often study phenomena at the science-policy nexus while working together with parties in practice (municipalities, provinces, water boards, ministries, citizen initiatives). Research themes:

1. Sustainable planning and citizen participation
2. Renewing and rethinking mapping and planning methods in today's network society
3. Governance of land-related resources: dealing with commons and externalities

Current research themes comprise: new governance models among public management and civil society for co-creating policy on sustainability challenges in cities and regions; facilitating citizen engagement and participatory policy design for the energy transition on municipal and neighbourhood level; citizen science for air quality and climate change monitoring; and gaming as policy support methodology.

Publications:

Volten, H.; Devilee, J.; Apituley, A.; Carton, L.J. ; Grothe, M.; Keller, C.; Kresin, F.; Land-Zandstra, A.; Noordijk, E.; Putten, E. van; Rietjes, J.; Snik, F.; Tielemans, E.; Vonk, J.; Voogt, M.; Wesseling, J. et al. (2018) Citizen science with small sensor networks. Collaboration between a Dutch EPA (RIVM) and local initiatives. Book chapter in "Citizen Science: Innovation in Open Science, Society and Policy" (2018). Edited by Susanne Hecker, Muki Haklay, Anne Bowser, Zen Makuch, Johannes Vogel and Aletta Bonn. October 2018. UCL Press. Full text: http://hdl.handle.net/2066/164809

DITOs consortium, (2018). European Clean Air Day - citizen science for clean air. DITOs policy brief.

Carton, L., I. Jansen-Dings et al (2018) Co-creation of a EU-wide citizen science network-of-networks for widespread urban air quality monitoring and urban-environmental planning action. Paper presented at AESOP, 11 July 2018, Gothenburg. https://tinyurl.com/CitizenScienceAirQuality-AESOP (presentation) and https://tinyurl.com/CitizenScienceAirQuality-intro (abstract)

Carton, L.J. & Ache, P.M. (2017). Citizen-sensor-networks to confront government decision-makers: Two lessons from the Netherlands. Journal of Environmental Management, 196, 234-251. Full text: doi: 10.1016/j.jenvman.2017.02.044

Carton, L.J., A.D. Samsura, G. Arciniegas, D. van Dijk, P. Ache (2017) Long-term vision building through game experiments: The case of climate change. Paper presented at the AESOP conference 'Spaces of Dialog for Places of Dignity', 12 July 2017, Lisbon. MapTable game interactive session, demonstrating Carbon Game, simulating climate negotiations.

Grothe, M., J. van den Broecke, L. Carton, H. Volten, R. Kieboom (2016) Smart Emission, building a spatial data infrastructure for an environmental citizen-sensor network. Paper presented at the Geospatial Sensor Webs Conference, August 30th, 2016 in Muenster, Germany. Full text: http://hdl.handle.net/2066/164563

Lenferink, S., G. Arciniegas, D.A. Sa,sura, L.J. Carton (2016) Integrating Geodesign and game experiments for negotiating urban development. Book chapter in: Nijhuis, S.; Zlatanova, S.; Dias, E. (ed.), Geo-Design: Advances in bridging geo-information technology, urban planning and landscape architecture, pp. 70-92.

Carton, L.J. and consortium partners (2015) Filling the feedback gap of place-related 'externalities' in smart cities: Empowering citizen-sensor-networks for participatory monitoring and planning. Article in proceedings of AESOP Conference 2015, Prague. Full text: http://www.ru.nl/publish/pages/774337/carton_etall_aesop-2015_v11_filling_thefeedback_gap_ofexternalities_insmartcities.pdf

Carton, L.J., P. van de Laak, M.A. Wiering (2015) Duurzaamheid en de stad. Book chapter in: Hospers, G-J.; Melik, R.G. van; Ernste, H. (ed.), Visies op de stad: van tuindorp tot smart city, pp. 141-158.

Ache,P., L.J. Carton (2015) Smart citizens 4 smart ruimte - het verkennen van vergezichten voor co-creatie van de stad van de toekomst . Book chapter in: Salet, W.; Vermeulen, R.; Wouden, R. van der (ed.), Toevoegen van ruimtelijke kwaliteit. Ruimtelijke kennis voor het Jaar van de Ruimte, pp. 124-135.

Carton, L.J., M. Oteman, M.A. Wiering, S. Kalf (2015) De slag om duurzame energie: De kracht van burgers. Idee, vol. 36, iss. 2, (2015), pp. 39.

Carton, L.J., P. Ache (2014) Using classic methods in a networked manner: seeing volunteered spatial information in a bottom-up fashion. Paper presented at Aesop 2014, from control to co-evolution, Session 1, track 16: Stakeholders from side line to centre in planning, paper 3.

Vellinga, P., L.J. Carton, C. van der Hendriks (2013) Streef naar een duurzame en harmonieuze samenleving . Sociaal-liberale grensverkenning, Hans van Mierlo Stichting, Wetenschappelijk Bureau D66, Den Haag.

Carton, L.J., W.A.H. Thissen (2009) Emerging conflict in collaborative mapping : Towards a deeper understanding? Journal of E nvironmental Management, vol. 90, iss. 6, pp. 1991-2001.